

## • Research Article

# Investigating short- and long-term transfer effects of a Taiji beginner course in participants' daily life

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**OBJECTIVE:** In recent years research investigating various health benefits of Taiji practice has markedly increased. Despite this growing scientific interest, essential questions such as to what extent a Taiji course may exert noticeable effects in participants' everyday life, what these effects are, and how and where potential transfer effects occur, have hardly been considered. The aim of our study was to explore transfer effects from a Taiji course into participants' daily lives.

**METHODS:** We conducted a longitudinal observational study in 45 healthy participants at the end of their three-month Taiji beginner course (tp1) and at two months (tp2) as well as one year after course completion (tp3). Participants were asked to report their Taiji practice behavior at all time points, as well as to rate and describe perceived transfer effects of Taiji course contents on their daily life at tp1 and tp3.

**RESULTS:** Transfer effects were reported by 91.1% of all respondents after course completion (tp1) and persisted in 73.3% at the one-year follow-up assessment (tp3), counting "increase of self-efficacy", "improvement of stress management", and "increase of body awareness" as the most frequently mentioned effects. Transfer effects predominantly occurred in participants' work and social environments, as well as during everyday activities in public areas. While self-reliant Taiji practice frequency significantly decreased from 82.2% at tp1 to 55.6% at tp3 ( $P < 0.001$ ), the magnitude of self-reported transfer effects did not ( $P = 0.35$ ). As explorative analyses revealed, regular Taiji course attendance was highly correlated with stronger transfer effects at tp1 ( $r = 0.51$ ;  $P < 0.001$ ) and tp3 ( $r = 0.35$ ;  $P = 0.020$ ). Participants reporting high self-reliant Taiji practice frequency at tp2 were likely to maintain a regular practice routine at tp3 ( $r = 0.42$ ;  $P < 0.004$ ), whereas self-reliant practice frequency and transfer effects at tp1 were positively correlated with self-reliant practice frequency at tp3 on a trend level ( $r < 0.27$ ;  $P > 0.08$ ).

**CONCLUSION:** Our data underline the importance of regular course participation for pronounced and long lasting transfer effects into participants' everyday life. We discuss that several context and process-related aspects of a Taiji intervention are potentially relevant factors for enhancement of transfer effect.

**KEYWORDS:** Tai Ji; daily life; transfer effects; self-efficacy; longitudinal study; healthy subjects

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## 1 Introduction

Taiji – variably spelled Taijiquan, Tai Chi or Tai Chi Chuan – is a mind-body practice originating from ancient Chinese martial arts based on principles rooted in daoist

philosophy<sup>[1-3]</sup>. As practiced nowadays, Taiji is a form of slow intentional body movements aiming to "... strengthen and relax the physical body and mind, enhance the natural flow of what the Chinese call qi (a nontranslatable word that describes life energy), and improve health, personal development, and self-defense"<sup>[3]</sup>.

In the West Taiji has received considerable attention in the general population, among patients, as well as in the research community<sup>[2-8]</sup>. The evidence base documenting a wide range of positive effects of Taiji practice on physical and mental wellbeing and supporting the potential of this mind-body practice in health care has markedly emerged in the last decade<sup>[8-15]</sup>. While in most Taiji studies the methodological approach was based on quantitative analyses of specific outcome values, qualitative Taiji research investigating perceived benefits of Taiji practice is still scarce, yet slowly emerging<sup>[16]</sup>. Qualitative analyses of practitioners' and teachers' self-reports consistently demonstrated a wide range of perceived physical, mental, emotional, social and spiritual effects of Taiji practice<sup>[16-19]</sup>. Even though the relevance of carrying over experience from Taiji classes into everyday life was mentioned in these publications, especially in the context of enhancing sustained self-reliant practice behavior, little is known about the nature of transfer effects, i.e., the perceived impact of an intervention on participants' daily life. Therefore, we have conducted a longitudinal observational study aiming to explore the following three aspects.

First, transfer effects. To what extent do participants of a Taiji beginner course report transfer effects immediately after course completion and one year later? And which daily life events do they mention to be affected by their Taiji beginner course?

As reported in a previous study<sup>[19]</sup>, prior to course participation, many applicants consistently stated daily life-related expectations of their upcoming Taiji course: 41% of them expected improvement in their stress management and 14% expected counterbalance with their daily work as a result of course participation, while 27% explicitly mentioned expecting a high transferability of course content into their daily life. To some extent, these expectations have also been attested by Taiji teachers<sup>[19]</sup>. Therefore we assumed that respective changes in participants' daily life would be reported after course completion. With respect to sustainability of transfer effects it can be speculated that in light of the broaden-and-build theory<sup>[20,21]</sup>, enhanced emotional wellbeing due to participation in a Taiji beginner course is likely to be linked with an increase in daily experience of positive emotions. This in turn might build a variety of consequential personal resources (e.g., increased mindfulness, purpose in life, social support), potentially having a strong and lasting impact on participants' daily life<sup>[22]</sup>. The fact that we have found persistently increased values in self-reported self-compassion, mindfulness and general self-efficacy, as well as decreased values in perceived stress in Taiji course participants two months after course completion<sup>[23,24]</sup> supports the assumption that long-term effects of a Taiji intervention on participants' daily life might be

reported one year after course completion.

Since the Taiji course in our study was designed to impart knowledge and skills based on basic Taiji motion principles, we expected transfer effects in daily physical activities to be frequently mentioned. Taking into account that physical behavior and mental wellbeing influence each other<sup>[25-27]</sup>, we assumed that mind-related transfer effects would also be commonly mentioned. Based on the fact that the majority of participants in our study were working adults, we made the assumption that transfer effects in the context of participants' working environments would be reported most frequently.

Second, self-reliant Taiji practice frequency. How does participants' self-reliant Taiji practice frequency develop after completion of the Taiji intervention?

The word "practice" in the term "mind-body practice" implies that the emergence of mind-body effects strongly relies on practicing respective intervention forms. In fact, those Taiji practitioners who maintain a regular practice routine in the long term are believed to experience and integrate the benefits of this mind-body practice into their daily life the best<sup>[1,28]</sup>. Even though participants of a Taiji beginner course might be highly motivated to pursue Taiji practice after course completion<sup>[29,30]</sup>, it cannot be taken for granted that a self-reliant Taiji practice routine will be consequently maintained in daily life, once the supportive setting of guided and regular Taiji classes is no longer provided. As found in a Taiji trial on patients with chronic heart failure, 68% of participants in the Taiji intervention group reported at a six-month follow-up assessment to have maintained regular self-reliant Taiji practice<sup>[31]</sup>. In another Taiji study on fall prevention in older persons a continuance rate of almost 50% was reported four months after completion of the intervention<sup>[32]</sup>. Based on these findings, we assumed a decline of self-reliant Taiji practice frequency by approximately 40% to 60% at the one-year follow-up assessment.

Third, predictive values. Which factors are predictively associated with self-reported transfer effects in long-term and sustained self-reliant practice behavior?

It is believed that people who devote time to meditative practices learn to draw positive attention to the self and, thus, become more compassionate towards themselves<sup>[33]</sup>. Hence we speculated that long-term transfer effects, which are likely to be based on such changes in self-attention, might be predictively associated with a stronger practice adherence in terms of a more regular course attendance and/or a more frequent self-reliant practice routine. On the other hand, it can also be assumed that carrying over Taiji course contents into everyday activities could facilitate sustained self-reliant practice behavior<sup>[16]</sup>. Therefore, strong transfer effects reported after the intervention might be predictively associated with sustained self-reliant practice behavior.

## 2 Methods

### 2.1 Study design and participants

This longitudinal observational study was nested within a randomized controlled trial examining psychobiological effects of Taiji on psychosocial stress reactivity in Taiji beginners<sup>[15]</sup>, and was formally approved by the Ethics Committee of the Canton of Bern, Switzerland.

Study participants were recruited through advertisement of the study on the homepage and on pin boards at the University of Bern, as well as at the University Hospital in Bern. Healthy Taiji novices aged from 18 to 50 years and fluent in German underwent a telephone screening controlling for the following exclusion criteria (referring to the last six months prior to screening): regular or occasional intake of any medication, any self-reported acute or chronic somatic or mental disorders, smoking of more than five cigarettes per day, consumption of more than two alcoholic drinks per day, consumption of any kind of addictive substances, previous participation in stress research projects, more than one week of predictable absence during the intervention period, or previous practical experience with Taiji exercises. Women who were using hormonal contraceptives, were pregnant or planning to become pregnant during the study were also excluded. Study participants were randomly assigned to one of two equivalent Taiji beginner courses. Detailed information about the course allocation is reported elsewhere<sup>[15]</sup>. Prior to participation, complete written and oral descriptions of the study were provided to all participants, and informed written consent was obtained. Participants who attended at least 50% of the Taiji course lessons were included in the study.

### 2.2 Taiji intervention

The two equivalent Taiji courses being offered to study participants took place at the University Hospital in Bern and started in September 2010 and in February 2011, respectively. Each one lasted for 12 weeks, consisting of 60-minute sessions twice a week. Emphasizing basic Taiji principles such as extension, relaxation and alignment of the body, as well as holistic and mindful body movements<sup>[34]</sup>, the first 18 sequences of the 37 Chen Man-Ch'ing Yang-Style Taiji short form<sup>[2]</sup> were taught to the participants. Each training session began with warm-up exercises (15 min), followed by practicing Taiji movements and reviewing the above mentioned basic principles (35 min), and ended with Taiji-related breathing and relaxation exercises (10 min). A Taiji teacher certified by the Swiss Society for Qigong and Taijiquan (Schweizerische Gesellschaft für Qigong und Taijiquan, SGQT), was in charge of all Taiji classes and recorded participants' course attendance. All participants were requested not to take part in any new mind-body or physical exercise program during their study

participation.

### 2.3 Data collection

Socio-demographic data (age, gender, education level, and occupation status) of all participants were assessed at baseline prior to Taiji-intervention, i.e., time point 0 (tp0). By conducting three online surveys, study participants were asked to report (with respect to the last four weeks) their average weekly self-reliant Taiji practice frequency right after course completion (tp1), as well as two months (tp2) and one year (tp3) later. To assess the self-reported magnitude of transfer effects, i.e., the perceived impact of a Taiji beginner course on participants' daily life, all participants were asked at tp1 and tp3 to rate a statement expressing a perception of Taiji-induced changes in daily life, i.e., "I notice that certain contents of the Taiji course exert an impact on my daily life", by indicating the degree of their agreement on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). If this statement was rated with 4 points (rather agree) or more, respective participants were asked to narratively describe in an open comment field their perceived changes and the relevant daily life events.

### 2.4 Data analysis

Data analysis was conducted using SPSS (version 18) statistical software package for Macintosh (IBM SPSS Statistics, Somers, NY, USA).

#### 2.4.1 General data description

Participants' socio-demographic characteristics, self-reliant Taiji practice frequency, and self-reported transfer effects were analyzed by using descriptive statistics. Unless indicated, all results are presented as mean  $\pm$  standard deviation.

#### 2.4.2 Analysis of qualitative data

Narrative questionnaire data were systematically prepared and analyzed by using a qualitative or quantitative approach<sup>[19,35]</sup>. In the qualitative approach, content-specific information reflecting Taiji-induced changes in participants' daily life has been inductively classified into main and sub categories as follows:

In a first step, each narrative response was screened to detect and mark all analytical units (i.e., all transfer effect-related aspects in each statement). Subsequently, those analytical units lacking in terminological clarity were explicitly stated. Afterwards, all analytical units were reduced to short paraphrases, comprehensible independent from its originally embedded context. In a further step, we conducted a content analysis of about 50% of all analytical units and inductively generated thematic categories. By classifying the remaining 50% of all analytical units the suitability of these categories was tested. After amending the initially derived categories, we reclassified all analytical units. Finally, we thematically captured the final categories into main categories. Each step of this analytical procedure has been conducted independently by two authors (AMS

and MN). After each step, results were compared and differences were discussed until consensus was found.

All categories were quantitatively described by indicating frequency of mentions in absolute and percentage values. In explorative data analysis, we compared participant-reported transfer effects at tp1 with those at tp3 by examining differences of frequency values in each main category using  $\chi^2$ -tests. Context-specific information regarding daily life events where transfer effects took place has been narratively summarized.

### 2.4.3 Analysis of quantitative data

Change in self-reported transfer effects from tp1 to tp3 was analyzed using the Wilcoxon test. Change in self-reliant Taiji practice behavior from tp1 to tp2 to tp3 was examined applying the Friedman test. To explore associations between Taiji course participation, self-reliant Taiji practice, and self-reported transfer effects, Spearman's correlation coefficients were calculated. All analyses were two-tailed, with the level of significance set at  $P \leq 0.05$ .

## 3 Results

### 3.1 Process of participation and characteristics of study participants

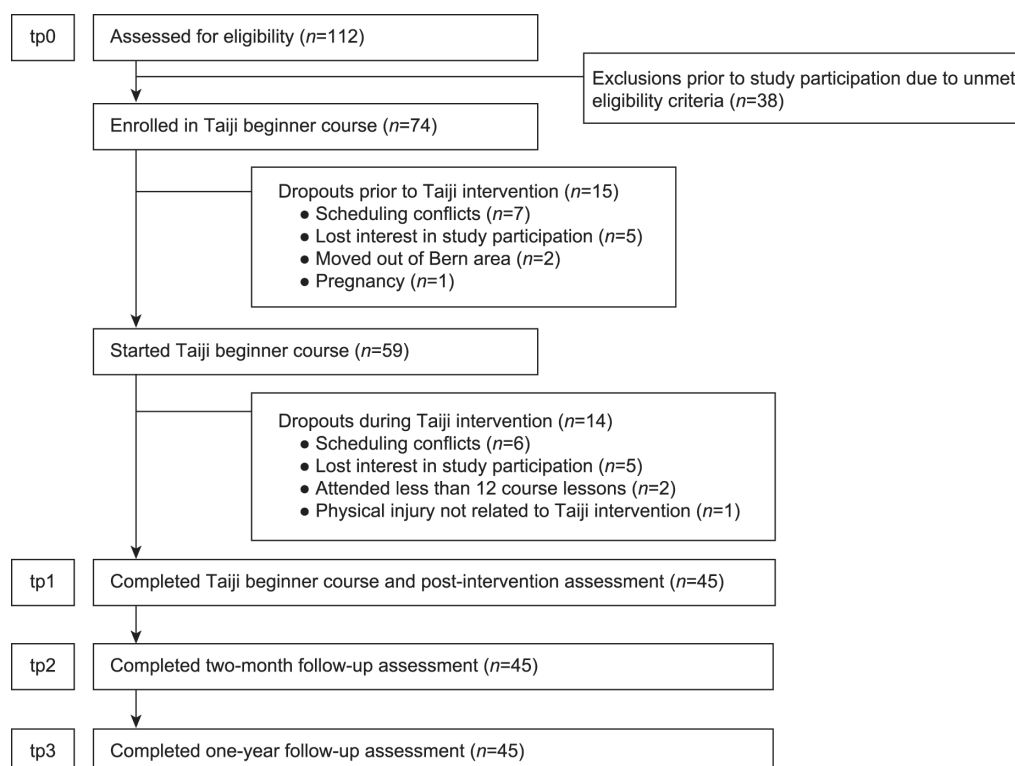
Figure 1 depicts the process of study participation. Of 112 applicants, 74 met the eligibility criteria for study

participation. 60.8% of recruited study participants ( $n=45$ ) completed the Taiji intervention, and all of them attended post-intervention, two month, and one-year follow-up assessments. Characteristics of study participants are presented in Table 1. On average, study participants were 35.8 years old, had a higher level of education, were predominantly full- or part-time workers, and attended 82.5% of all Taiji classes. Socio-demographic characteristics of dropouts did not significantly differ from subjects completing the Taiji intervention ( $P > 0.44$ ).

### 3.2 Results from analysis of qualitative data

At the post-intervention assessment (tp1) 41 participants (91.1% of all course finishers), and one year later (tp3) 33 participants (73.3%), made statements related to their perceived transfer effects of the Taiji course contents in their daily life. In qualitative analysis of these statements, content-specific information units were extracted and categorized into three main categories (Table 2) and 19 sub-categories of transfer effects (Table 3).

As shown in Table 2, mind-related transfer effects were mentioned most frequently at tp1 (58.0%) and increased on a trend level ( $P = 0.06$ ) at tp3 (68.8%). While post-intervention assessment statements referring to body-related transfer effects represented 21.6% of all mentioned transfer effects, this frequency value (5.1%) was significantly lower ( $P < 0.001$ ) one year later. Besides, 20.7% of all



**Figure 1** Flow diagram depicting the progress of participation  
tp: time point.

**Table 1** Description of study participants' characteristics

Characteristics of study participants ( <i>n</i> =45)	Value
Age in years (mean $\pm$ SD; range)	35.8 $\pm$ 7.8; 23-50
Gender (female/male; %)	33/12; 73.3%/26.7%
Smoking (no/yes i.e. < 5 cigarettes per day; %)	37/8; 82.2%/17.8%
Body mass index (kg/m <sup>2</sup> , mean $\pm$ SD; range)	22.8 $\pm$ 3.4; 18.7-32.0
Education (with/without high school degree; %)	34/11; 75.5%/24.5%
Occupational status (full- or part-time workers/students; %)	40/5; 88.9%/11.1%
Attended Taiji classes (mean $\pm$ SD; range)	
- in hour	19.8 $\pm$ 3.3; 12-24
- in %	82.5% $\pm$ 13.8%; 50%-100%
Weekly self-reliant Taiji practice frequency (mean $\pm$ SD; range)	
- at post-intervention assessment (tp1)	1.82 $\pm$ 1.42; 0-7
- at two-month follow-up assessment (tp2)	0.93 $\pm$ 0.84; 0-3
- at one-year follow-up assessment (tp3)	0.48 $\pm$ 0.74; 0-3
Self-reported transfer effects (mean $\pm$ SD; range)	
- at post-intervention assessment (tp1)	4.31 $\pm$ 1.08; 1-6
- at one-year follow-up assessment (tp3)	4.04 $\pm$ 1.43; 1-6

SD: standard deviation; tp: time point.

**Table 2** Main categories of mentioned transfer effects at post-intervention (tp1) and one-year follow-up assessment (tp3)

Main categories of transfer effects	Mentions at tp1 ( <i>n</i> = 174)	Mentions at tp3 ( <i>n</i> = 157)	$\Delta$ from tp1 to tp3	<i>P</i> value
Body-related	37 (21.6%)	8 (5.1%)	-17.7%	< 0.001
Mind-related	101 (58.0%)	108 (68.8%)	+10.9%	0.06
Mind-body-related	36 (20.7%)	41 (26.1%)	+5.4%	0.30

Data are expressed in absolute and % values; the differences between tp1 and tp3 were analyzed by  $\chi^2$ -tests. tp: time point.

statements at tp1 and comparably 26.1% at tp3 were categorized as mind-body-related transfer effects (*P* = 0.30)

With respect to frequencies of transfer effects as represented in the sub-categories, "increase of self-efficacy" was mentioned most frequently at tp1 (17.2% of all mentioned transfer effects) and even markedly increased at tp3 (30.6%). This was followed by "improvement of stress management" with 10.9% at tp1 and persistently elevated to 13.4% at tp3. "Increase of body awareness" represented 9.2% of all transfer effects at tp1 and 7.0% at tp3. No negative transfer effects have been reported. Complete results are listed in Table 3.

With respect to the context of transfer effects, most of them were reported to take place in participants' working and social environments, as well as in public areas, e.g., while walking on the street, during bus rides, or waiting at the bus stop. Waiting periods were frequently used to reflect and gently adjust not only their body alignment, but also their general behavior patterns in daily life. Improved stress management in response to Taiji course participation

has been appreciated by many participants as a valuable resource when being confronted with daily hassles and challenges at work and/or distressing circumstances and critical life events in family, such as divorce and loss of close relatives. While some participants reported regular Taiji practice at home in the morning or evening hours, others practiced Taiji occasionally at or after work, depending on their need for calming down and stabilizing themselves. The latter respondents mentioned that they sometimes take a short time out from their current activities to go through the Taiji form.

Some participants integrated Taiji principles in their leisure activities like skiing, slack-lining, hiking, horseback riding, and playing an instrument. Others applied Taiji principles at work, e.g., when lifting heavy weights, teaching students in physical education classes, or giving lectures and seminar lessons.

### 3.3 Results from analysis of quantitative data

Mean values of weekly self-reliant Taiji practice frequency and self-reported transfer effects are presented in Table 1.



**Table 3** Sub-categories of mentioned transfer effects at post-intervention (tp1) and one-year follow-up assessment (tp3)

Sub-categories of transfer effects	Frequency of mentioned transfer effects		Sample phrases
	at tp1	at tp3	
<i>Body-related transfer effects</i>			
Improvement of motor coordination	16 (9.2%)	3 (1.9%)	<i>“To initiate a body rotation not from my shoulder but from my center, ... it is a special feeling that comes from within.”</i>
Improvement of body alignment/posture	8 (4.6%)	1 (0.6%)	<i>“I have noticed that I am standing in a much more stable and relaxed way when waiting at a bus stop or interacting with others at social events.”</i>
Increase of looseness	6 (3.5%)	1 (0.6%)	<i>“Thanks to increased awareness of my physical condition, I can consciously relax more and loosen up tightened muscles.”</i>
Improvement of balance	4 (2.3%)	3 (1.9%)	<i>“ ... especially during bus rides I am more aware of kinetic energies and find it easier to neutralize them and keep well rooted.”</i>
Bodily functioning	3 (1.7%)	0 (0.0%)	<i>“Taiji helps me to fall more easily asleep at night.”</i>
<i>Mind-related transfer effects</i>			
Increase of self-efficacy	30 (17.2%)	48 (30.6%)	<i>“I know how to calm myself down in stressful encounters and have a much more conscious treatment of myself.”</i>
Improvement of stress management	19 (10.9%)	21 (13.4%)	<i>“I am handling stressful situations in a more laid-back manner. I first observe, reflect and eventually react.”</i>
Increase of internal balance and peace of mind	14 (8.0%)	8 (5.1%)	<i>“Taiji enables me to face some ‘unpleasant circumstances’ with rather more equanimity.”</i>
Fostering of mindfulness	9 (5.2%)	11 (7.0%)	<i>“It [Taiji] inspires me to do my work in a decelerated and more considered way.”</i>
Fostering of self-compassion	5 (2.9%)	5 (3.2%)	<i>“I treat myself much more consciously. Before starting the Taiji course I was always forcing myself to make full use of my time.”</i>
Fostering of social competence	4 (2.3%)	4 (2.5%)	<i>“I am treating myself and others more heedfully.”</i>
Increase of power of concentration	4 (2.3%)	1 (0.6%)	<i>“I have noticed that through Taiji practice I am much more focused and calm when playing my instrument.”</i>
Feeling of gratitude	2 (1.1%)	6 (3.8%)	<i>“Slowness is something precious.”</i>
Knowledge	0 (0.0%)	2 (1.3%)	<i>“For me as a coach, knowledge about Taiji principles is very useful when instructing junior athletes how to distribute their weight and align their body to improve their balance and stability.”</i>
Lively interest in Taiji	0 (0.0%)	2 (1.3%)	<i>“I am interested in information about Taiji that is offered in various media.”</i>
<i>Mind-body-related transfer effects</i>			
Increase of body awareness	16 (9.2%)	11 (7.0%)	<i>“For me, my body awareness has become markedly refined.”</i>
Increase of relaxation	11 (6.3%)	2 (1.3%)	<i>“Thanks to an increased awareness of my physical condition. I am able to relax more consciously and loosen up tightened muscles.”</i>
Ability to make self-corrections	9 (5.2%)	18 (11.5%)	<i>“I breathe more consciously and if I feel the need to do so, I make slight corrections in my body posture.”</i>
Holistic health promotion	0 (0.0%)	10 (6.4%)	<i>“Every day I try to save some time for practicing Taiji, Yoga or outdoor activities. I feel an increased need to take care of my own physical and mental wellbeing.”</i>

Data are expressed in absolute and % values.

While self-reliant Taiji practice frequency significantly decreased over time ( $\chi^2 = 35.24$ ;  $df = 2$ ;  $P < 0.001$ ), no significant change in the magnitude of self-reported transfer effects was observed from tp1 to tp3 ( $Z = -0.94$ ;  $P = 0.35$ ). At tp1 82.2% of the participants reported regular self-reliant Taiji practice (including daily, weekly, and monthly), while the continuance rate at tp2 was 66.7%, and 55.6% at tp3.

Explorative data analysis revealed that regular course participation was associated with a more frequent self-reliant Taiji practice at tp1 ( $r = 0.30$ ;  $P = 0.047$ ), but not at tp2 and tp3 ( $P$  values  $> 0.24$ ). Those participants who attended Taiji classes more frequently reported stronger transfer effects after course completion ( $r = 0.51$ ;  $P < 0.001$ ), as well as at the one-year follow-up assessment ( $r = 0.35$ ;  $P = 0.020$ ). Respondents reporting stronger transfer effects at the end of the Taiji intervention were also likely to do so at the one-year follow-up ( $r = 0.43$ ;  $P < 0.003$ ). The experience of transfer effects at tp1 was on a trend level positively correlated with self-reliant practice frequency at tp3 ( $r = 0.26$ ;  $P = 0.08$ ).

Self-reliant Taiji practice frequency at tp1 was significantly positively correlated with self-reliant Taiji practice frequency at tp2 ( $r = 0.53$ ;  $P < 0.001$ ) and on a trend level at tp3 ( $r < 0.26$ ;  $P > 0.08$ ). Only those participants who maintained a regular Taiji practice behavior two months after course completion also reported a sustained self-reliant practice behavior at tp3 ( $r = 0.42$ ;  $P < 0.004$ ). Higher self-reliant Taiji practice frequency at tp1 was associated with stronger transfer effects at tp1 ( $r = 0.33$ ;  $P = 0.028$ ), but had no prognostic value for long-term transfer effects at tp3 ( $P = 0.30$ ). Participants' self-reliant Taiji practice frequency at tp3 was found to be significantly positively correlated with the magnitude of self-reported transfer at tp3 ( $r = 0.46$ ;  $P = 0.001$ ).

#### 4 Discussion

Our longitudinal observational study is the first to explore short- and long-term transfer effects of Taiji beginner course contents on participants' everyday life. We have found that 41 out of 45 participants (91.1%) reported transfer effects right after course completion, which persisted in 33 participants (73.3%) at the one-year follow-up assessment. On average, the 45 participants reported transfer-effects of moderate intensity. These results indicate that a Taiji intervention over 12 weeks may have remarkable and long-lasting beneficial effects on participants' daily life, and thus seem to confirm the previously assessed expectation of Taiji novices regarding the transferability of Taiji beginner course contents into their daily life<sup>[19]</sup>. Specific mind-related transfer effects such as "increase of self-efficacy" and "improvement of stress management",

which were the most frequently mentioned ones at tp1, were mentioned even more often at tp3 (see Table 2). This finding is in line with previous research that has shown immediate inhibiting effects of three months of Taiji training on psychobiological stress reactivity in healthy Taiji novices<sup>[15,24]</sup>. Furthermore, a prior study showed that a Taiji-induced reduction of perceived stress was mediated by an increase in general self-efficacy in response to the Taiji intervention, with participants reporting persistently increased general self-efficacy values two months after the intervention<sup>[24]</sup>. Our data now suggest that this also seems to be valid for a longer period of time: the prevalence of statements expressing an enhancement of self-efficacy in response to the Taiji intervention considerably increased over one year (see Table 3). Interestingly, while the frequency of mentioned mind-body-related transfer effects did not markedly change over time, body-related transfer effects, e.g., "improvement of motor coordination, and body alignment", were significantly more frequently reported at tp1 compared to tp3. Physical effects of regular Taiji practice seem to be an important reason for maintaining a regular practice routine among elderly and physically handicapped practitioners<sup>[18]</sup>. The fact that the participants in our study were all healthy and had no physical complaints and limitations to be alleviated might explain why body-related effects of Taiji practice on participants' everyday life were not mentioned that frequently at the one-year follow-up assessment. Another possible explanation might be that right after course completion respondents are likely to be more aware of their recently acquired physical skills than one year later. Hence, in our study population, body-related transfer effects seem to be prone to habituation and adaptation<sup>[36,37]</sup>, while the relevance of mind-related transfer effects increased over time, which is in accordance with the initially mentioned broaden-and-buildtheory<sup>[20-22]</sup>. As the majority of participants in our study were full- or part-time workers, it is not surprising that most transfer effects were reported to occur in the context of participants' work environments. However, transfer effects in participants' social environments, as well as during their everyday activities, especially in public areas, were also commonly mentioned. This finding pledges for a potentially broad range of everyday circumstances and activities where Taiji principles might be physically and/or mentally implemented.

As explorative analyses revealed, regular course attendance was significantly correlated with the magnitude of transfer effects right after, as well as one year after course completion. We therefore consider participants' regular course attendance as a basic prerequisite for transfer effects. Hence, potential course components that improve participants' adherence to the Taiji intervention and consequently enhance transfer effects deserve further attention. With respect to our intervention, we believe that not only do the previously

described course contents play an important role, but the course modality, as well as the applied teaching approach, is highly relevant to enhancing participants' course attendance rate and transfer effects. Regarding the course modality, we offered six Taiji classes on two different days, over lunch break as well as in the evening hours, to facilitate participants' regular class attendance. This approach also led to medium class sizes varying from 8 to 15 participants, which allowed for a more individualized and thus probably more effective and motivating coaching of participants' learning. The same Taiji teacher was in charge of all classes, which is a basic requirement for a trustful teacher-student relationship that is believed to foster working alliance and to enhance transmission of course contents<sup>[19,38]</sup>.

Regarding the applied teaching method, Taiji movements and its underlying basic principles were taught in a multimodal way. Participants' implicit procedural learning through imitating the movements of the teacher was enriched by explicit explanations of bio-mechanic aspects of the Taiji movements in combination with supported introspection while being in motion. Additionally, metaphors and anecdotes associated with the names of the Taiji movements were used and participants were encouraged to describe their perception of their movements by themselves. In fact, Gick and Holyoak<sup>[39,40]</sup> reported that explicit abstraction of implicit actions (which in our study would correspond with the intellectual understanding and paraphrasing of basic Taiji principles) increases the accessibility of this knowledge in other domains. It has also been postulated that "active self-monitoring", e.g., introspection, is an important factor in successful transfer of coping strategies into daily life<sup>[41]</sup>. The applied teaching approach was a playful experience-oriented one rather than a performance-oriented one. We believe that such a joyful approach towards learning Taiji movements and principles can foster positive feelings towards this mind-body practice, which are likely to flourish in practitioners' everyday life. Notably this transfer effect-enhancing aspect of joyfulness of an activity has also been postulated in Fredricksons' broaden-and-build theory as a key component for the upward spiral of positive emotions: "...joy sparks the urge to play, interest sparks the urge to explore, contentment sparks the urge to savour and integrate, and love sparks a recurring cycle of each of these urges within safe, close relationships."<sup>[22]</sup> To elucidate the relevance of context- and process-related aspects, in which the teaching and learning of Taiji is embedded, on transfer effects in particular and on outcome parameters in general, the implementation of the broaden-and-build theory in future Taiji research appears to be very promising.

With regard to self-reliant practice behavior, 82.2% of all course participants reported that they have regularly

practiced Taiji by themselves during the intervention period and 55.6% still did so one year after completing their Taiji beginner course. This finding underlines the potential sustainability of a 12-week Taiji beginner course. Interestingly, those participants who reported frequent self-reliant Taiji practice two months after the intervention were most likely to maintain a regular practice routine at tp3 ( $r = 0.42$ ;  $P < 0.004$ ). To increase participants' continuance rate in the long-term, additional measurements to facilitate self-reliant Taiji practice during the two months following the intervention might be considered.

The following limitations need to be addressed. First, as our findings are related to healthy young to middle aged adults with a predominantly good educational background, the generalizability of our results to clinical populations remains unclear. Second, we conducted an observational study without a control group. Hence, our results are restricted to Taiji only. For future comparative studies an inclusion of an active control group should be considered. Third, except for course attendance rate, all data relied on participants' retrospective self-report only and data assessment was unblinded. Therefore, participants' responses might be biased by low recall accuracy, social desirability and/or other systematic response tendencies. Blinded data collection and assessment of third party ratings should be considered for future research. Fourth, it may be argued that participants were told what to expect from the Taiji intervention in terms of transfer into their daily life, which eventually may be reflected in the data. However, as requested by the local ethics committee, we tried our best not to influence participants' course-related expectations by providing them a neutral oral and written description of the study. During the intervention participants were frequently encouraged to explore the Taiji movements and principles in their daily life by the Taiji teacher, yet the explicit mentioning of specific areas and/or activities, where course contents might be transferred to, was avoided as much as possible. Still, the potential occurrence of priming effects cannot be ruled out and should therefore be considered in further studies.

The main strengths of this study are the novelty of exploring the impact of a Taiji intervention on participants' everyday life, the 100% response rate at all time points of all participants completing the intervention, and the one-year follow-up assessment allowing an investigation of long-term transfer effects and continuance rate in Taiji practice.

In conclusion, we have found that participants in a 12-week Taiji beginner course reported a large variety of short- and long-term transfer effects of course contents into their daily life. In particular, our study results highlight the relevance of regular course attendance for strong and sustained transfer effects outside the course setting. Context-



and process-related aspects of learning and teaching Taiji should be considered in future Taiji research, as they are believed to affect the magnitude of transfer effects and other outcome parameters.

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## 6 Competing interests

The authors declare that they have no competing interests.

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